

What is claimed is:

[Claim 1] 1. An etching process, comprising:

providing a material layer having a bottom anti-reflection coating (BARC) and a patterned photoresist layer thereon;

etching the BARC using the patterned photoresist layer as a mask, wherein polymer as an etching by-product is formed on the patterned photoresist layer;

performing a cleaning step to remove the polymer from the patterned photoresist layer; and

etching the material layer using the patterned photoresist layer as a mask.

[Claim 2] 2. The etching process of claim 1, wherein the cleaning step comprises using an ionized gas to remove the polymer from the patterned photoresist layer.

[Claim 3] 3. The etching process of claim 2, wherein the ionized gas has a higher etching rate to the polymer than to the material layer.

[Claim 4] 4. The etching process of claim 1, wherein the material layer comprises a polysilicon layer.

[Claim 5] 5. The etching process of claim 4, wherein the ionized gas contains fluorine ions, oxygen ions, or a combination thereof.

[Claim 6] 6. The etching process of claim 1, wherein the BARC comprises an inorganic material.

[Claim 7] 7. The etching process of claim 1, wherein the BARC comprises an organic material.

[Claim 8] 8. The etching process of claim 1, further comprising trimming the patterned photoresist layer after the material layer is provided.

[Claim 9] 9. A patterning process, comprising:

sequentially forming a bottom anti-reflection coating (BARC) and a photoresist layer on a material layer;

performing a lithography process to pattern the photoresist layer;

trimming the patterned photoresist layer;

etching the BARC using the patterned photoresist layer as a mask, wherein polymer as an etching by-product is formed on the patterned photoresist layer;

performing a cleaning step to remove the polymer from the patterned photoresist layer; and

etching the material layer using the patterned photoresist layer as a mask, wherein the step of etching the BARC, the cleaning step and the step of etching the material layer are performed in-situ.

[Claim 10] 10. The patterning process of claim 9, wherein the cleaning step comprises using an ionized gas to remove the polymer from the patterned photoresist layer.

[Claim 11] 11. The patterning process of claim 10, wherein the ionized gas has a higher etching rate to the polymer than to the material layer.

[Claim 12] 12. The patterning process of claim 9, wherein the material layer comprises a polysilicon layer.

[Claim 13] 13. The patterning process of claim 12, wherein the ionized gas contains fluorine ions, oxygen ions, or a combination thereof.

[Claim 14] 14. The patterning process of claim 9, wherein the BARC comprises an inorganic material.

[Claim 15] 15. The patterning process of claim 9, wherein the BARC comprises an organic material.